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Basic Stoichiometry (Theoretical and Percent Yield)

Part 1: Mole \longleftrightarrow Mass Conversions

Convert the following number of moles of chemical into its corresponding mass in grams.

- | | |
|-------------------------------------|---------------------------------------|
| 1. 0.436 moles of ammonium chloride | 2. 2.360 moles of lead (II) oxide |
| 3. 0.031 moles of aluminum iodide | 4. 1.077 moles of magnesium phosphate |
| 5. 0.50 moles of calcium nitrate | |

Convert the following masses into their corresponding number of moles.

- | | |
|--------------------------------------|--------------------------------|
| 6. 23.5 g of sodium chloride | 7. 0.778 g of sodium cyanide |
| 8. 0.250 g of water | 9. 169.45 g of calcium acetate |
| 10. 79.9 g of potassium permanganate | |

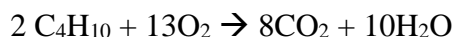
Part 2: Moles \longleftrightarrow Number of Particles Conversions

Convert the following number of moles into their corresponding number of particles.

- | | |
|---------------------------------------|---|
| 11. 0.0455 moles of hydrochloric acid | 12. 1.2 moles of glucose (C ₆ H ₁₂ O ₆) |
| 13. 0.32 moles of sodium bicarbonate | |

Part 3: Solve the following stoichiometry grams-grams problems:

- 1) The combustion of a sample of butane, C₄H₁₀ (lighter fluid), produced 2.46 grams of water.



- (a) How many moles of water formed?
- (b) How many moles of butane burned?
- (c) How many grams of butane burned?
- (d) How much oxygen was used up in moles?
- (e) How much oxygen was used up in grams?
- (f) What is the Percent yield of water if 0.80g was actually produced based on the theoretical values in a-e?

- 2) Using the following equation: $2 \text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow 2 \text{H}_2\text{O} + \text{Na}_2\text{SO}_4$

How many grams of sodium sulfate will be formed if you start with 200 grams of sodium hydroxide and you have an excess of sulfuric acid? (**ANSWER 355.3g Na₂SO₄**)

- 3) Using the following equation: $\text{Pb}(\text{SO}_4)_2 + 4 \text{LiNO}_3 \rightarrow \text{Pb}(\text{NO}_3)_4 + 2 \text{Li}_2\text{SO}_4$

How many grams of lithium nitrate will be needed to make 250 grams of lithium sulfate, assuming that you have an adequate amount of lead (IV) sulfate to do the reaction?

- 4) Using the following equation: $\text{Fe}_2\text{O}_3 + 3 \text{H}_2 \rightarrow 2 \text{Fe} + 3 \text{H}_2\text{O}$

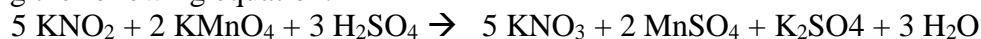
Calculate how many grams of iron can be made from 16.5 grams of Fe₂O₃ by the following equation.

- 5) Using the following equation: $2 \text{I}_2 + \text{KIO}_3 + 6\text{HCl} \rightarrow 5\text{ICl} + \text{KCl} + 3\text{H}_2\text{O}$

Calculate how many grams of iodine are needed to prepare 28.6 grams of ICl by this reaction.

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6) Using the following equation:



- How many moles and how many grams of KMnO_4 are needed to carry out this reaction on 11.4 grams of KNO_2 ?
- If 11.4 grams of KNO_2 was reacted with excess H_2SO_4 and KMnO_4 , what mass of MnSO_4 is theoretically produced?
- How many grams of MnSO_4 is actually produced if the percent yield in the reaction was only 23%?

7) Using the following equation: $4 \text{NH}_3 + 5 \text{O}_2 \rightarrow 4 \text{NO} + 6 \text{H}_2\text{O}$

How many moles and how many grams of oxygen (O_2) are needed to react with 56.8 grams of ammonia by this reaction?

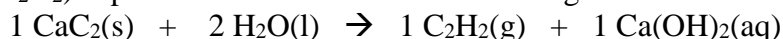
8) Using the following equation: $1 \text{NaIO}_3 + 6 \text{HI} \rightarrow 3 \text{I}_2 + \text{NaI} + 3 \text{H}_2\text{O}$

Calculate the number of moles and the number of grams of iodine (I_2) that can be made this way from 16.4 grams of NaIO_3 .

9) $1 \text{Mg(s)} + 2 \text{HCl(aq)} \rightarrow 1 \text{MgCl}_2\text{(aq)} + 1 \text{H}_2\text{(g)}$

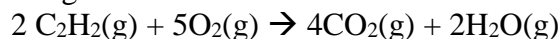
- How many grams of HCl are consumed by the reaction of 2.50 moles of magnesium?
- What is the mass in grams of H_2 gas when 4.0 moles of HCl is added to the reaction?
- If 2.25 g of H_2 gas was recovered from the reaction of 4.0 mol of HCl with excess mg, what was the percent yield?

10) Acetylene gas (C_2H_2) is produced as a result of the following reaction.



- If 3.20 moles of CaC_2 are consumed in this reaction, how many grams of H_2O are needed?
- How many grams of Ca(OH)_2 would be formed with 3.20 moles of CaC_2 ?

11) Acetylene gas, C_2H_2 , is used in welding, produces an extremely hot flame when it burns in pure oxygen according to the following reaction.



How many moles of water (H_2O) are produced when 25.0 grams of C_2H_2 burns completely?

12) $3 \text{Mg} + 1 \text{Fe}_2\text{O}_3 \rightarrow 2 \text{Fe} + 3 \text{MgO}$

How many moles of iron, Fe, are produced with 25.0 grams of magnesium, Mg?

13) Laughing gas (nitrous oxide, N_2O) is sometimes used as an anesthetic in dentistry.



- How many moles of NH_4NO_3 are required to produce 33.0g of N_2O ?
- How many moles of water are produced with 45.0g of N_2O ?

Part 3, Some Answers

1. a. 0.137mol H_2O b. 0.0273mol C_4H_{10} c. 1.59g C_4H_{10} d. 0.178mol O_2 e. 5.69 g O_2 f. 32.5% 3. 386.3g of LiNO_3
6. a. 5.3E^2 mol & 8.48g KMnO_4 b. 8.1g MnSO_4 c. 1.86g MnSO_4 9. a. 182g HCl b. 4.0g H_2 c. 56.25%
10. a. 115g H_2O b. 237g Ca(OH)_2 11. 0.960 moles H_2O 12. 0.686 mole Fe 13. a. 0.749 mole NH_4NO_3 b. 2.04 mole H_2O

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